Amendments To The Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Previously Presented) Steel plate for ultra-high-strength linepipe having excellent low-temperature toughness consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%
P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%
Al	:	not more than 0.10 mass%

and, one or more of:

Ni	:	0.1 to 1.5 mass%
B	:	less than 3 ppm
V	:	not more than 0.10 mass%
Cu	:	not more than 1.0 mass%
Cr	:	not more than 1.0 mass%
Ca	:	not more than 0.01 mass%
REM	:	not more than 0.02 mass%
Mg	:	not more than 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0, and having a microstructure composed of degenerate upper bainite of more than 70%, in which;

the ratio (Hv-avep)/(Hv-M) between the average Vickers hardness Hv-avep in the direction of thickness and the martensitic hardness Hv-M determined by carbon content is between 0.8 and 0.9, and the transverse tensile strength TS-Tp is between 880 MPa and 1080 MPa,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) + Mo - 1$$

$$Hv\text{-}M = 270 + 1300C$$

wherein the symbols of elements designate the mass% of the individual elements.

2. (Previously Presented) Steel plate for ultra-high-strength linepipe having excellent low-temperature toughness consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%
P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%
Al	:	not more than 0.10 mass%
B	:	3 ppm to 0.0025 mass%

and, one or more of:

Ni	:	0.1 to 1.5 mass%
N	:	0.001 to 0.006 mass%

V	:	not more than 0.10 mass%
Cu	:	not more than 1.0 mass%
Cr	:	not more than 1.0 mass%
Ca	:	not more than 0.01 mass%
REM	:	not more than 0.02 mass%
Mg	:	not more than 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0, and having a microstructure composed of degenerate upper bainite of more than 70%, in which;

the ratio (Hv-avep)/(Hv-M) between the average Vickers hardness Hv-avep in the direction of thickness and the martensitic hardness Hv-M determined by carbon content is between 0.8 and 0.9, and the transverse tensile strength TS-Tp is between 880 MPa and 1080 MPa,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) + 2Mo$$

$$Hv\text{-}M = 270 + 1300C$$

wherein the symbols of elements designate the mass% of the individual elements.

3. (Currently Amended) Steel plate for ultra-high-strength linepipe having excellent low-temperature toughness ~~described in claim 1, containing~~ <u>consisting essentially of</u>:

<u>C</u>	<u>:</u>	<u>0.03 to 0.07 mass%</u>
<u>Si</u>	<u>:</u>	<u>not more than 0.6 mass%</u>
<u>Mn</u>	<u>:</u>	<u>1.5 to 2.5 mass%</u>
<u>P</u>	<u>:</u>	<u>not more than 0.015 mass%</u>
<u>S</u>	<u>:</u>	<u>not more than 0.003 mass%</u>
<u>Mo</u>	<u>:</u>	<u>0.15 to 0.60 mass%</u>
<u>Nb</u>	<u>:</u>	<u>0.01 to 0.10 mass%</u>

Ti : 0.005 to 0.030 mass%

Al : not more than 0.10 mass%

and, one or more of:

Ni : 0.1 to 1.5 mass%

B : less than 3 ppm

V : not more than 0.10 mass%

Cu : not more than 1.0 mass%

Cr : not more than 1.0 mass%

Ca : not more than 0.01 mass%

REM : not more than 0.02 mass%

Mg : not more than 0.006 mass%

N : 0.001 to 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0, and having a microstructure composed of degenerate upper bainite of more than 70%, in which;

the ratio (Hv-avep)/(Hv-M) between the average Vickers hardness Hv-avep in the direction of thickness and the martensitic hardness Hv-M determined by carbon content is between 0.8 and 0.9, and the transverse tensile strength TS-Tp is between 880 MPa and 1080 MPa,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) + Mo - 1$$

$$Hv\text{-}M = 270 + 1300C$$

wherein the symbols of elements designate the mass% of the individual elements.

4. (Original) Steel plate for ultra-high-strength linepipe having excellent low-temperature toughness described in claim 3, in which the relationship Ti - 3.4 N > 0 is satisfied (wherein the symbols of elements designate the mass% of the individual elements).

5. (Previously Presented) Steel plate for ultra-high-strength linepipe having excellent low-temperature toughness described in claim 1, in which the V-notch Charpy value at -20 °C is not lower than 200J.

6. (Previously Presented) Steel plate for ultra-high-strength linepipe having excellent low-temperature toughness described in claim 1, in which the longitudinal tensile strength TS-Lp is not greater than 0.95 times the transverse tensile strength TS-Tp.

7. (Previously Presented) Steel plate for ultra-high-strength linepipe having excellent low-temperature toughness described in claim 1, in which the yield ratio in the direction of rolling (YS - Lp)/(TS - Lp), which is the ratio of the 0.2% offset yield strength YS - Lp in the direction of rolling to the tensile strength TS - Lp in the direction of rolling is not greater than 0.8.

8. (Previously Presented) Ultra-high-strength linepipe having excellent low-temperature toughness prepared by seam-welding steel plate consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%
P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Ni	:	0.1 to 1.5 mass%
Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%
Al	:	not more than 0.06 mass%

and, one or more of:

B	:	not more than 0.0025 mass%

N	:	0.001 to 0.006 mass%
V	:	not more than 0.10 mass%
Cu	:	not more than 1.0 mass%
Cr	:	not more than 1.0 mass%
Ca	:	not more than 0.01 mass%
REM	:	not more than 0.02 mass%
Mg	:	not more than 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0, and having a microstructure composed of degenerate upper bainite of more than 70%, in which;

the ratio (Hv-ave)/(Hv-M) between the average Vickers hardness Hv-ave in the direction of thickness of the base metal and the martensitic hardness Hv-M determined by carbon content is between 0.8 and 0.9 and the circumferential tensile strength TS-C is between 900 MPa and 1100 MPa,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) +$$

$$(1 + \beta)Mo - 1+\beta$$

where $\beta = 1$ when $B \geq 3$ ppm and $\beta = 0$ when $B < 3$ ppm

$$Hv\text{-}M = 270 + 1300C$$

wherein the symbols of elements designate the mass% of the individual elements.

9. (Previously Presented) Ultra-high-strength linepipe having excellent low-temperature toughness prepared by seam-welding steel plate consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%

P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%
Al	:	not more than 0.10 mass%

and, one or more of:

Ni	:	0.1 to 1.5 mass%
B	:	less than 3 ppm
V	:	not more than 0.10 mass%
Cu	:	not more than 1.0 mass%
Cr	:	not more than 1.0 mass%
Ca	:	not more than 0.01 mass%
REM	:	not more than 0.02 mass%
Mg	:	not more than 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0, and having a microstructure composed of degenerate upper bainite of more than 70%, in which;

the ratio (Hv-ave)/(Hv-M*) between the average Vickers hardness Hv-ave in the direction of thickness of the base metal and the martensitic hardness Hv-M* determined by carbon content is between 0.75 and 0.9 and the circumferential tensile strength TS-C is between 900 MPa and 1100 MPa,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) + Mo - 1$$

$$Hv\text{-}M^* = 290 + 1300C$$

wherein the symbols of elements designate the mass% of the individual elements.

10. (Previously Presented) Ultra-high-strength linepipe having excellent low-temperature toughness prepared by seam-welding steel plate consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%
P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%
Al	:	not more than 0.10 mass%
B	:	3 ppm to 0.0025 mass%

and, one or more of:

Ni	:	0.1 to 1.5 mass%
N	:	0.001 to 0.006 mass%
V	:	not more than 0.10 mass%
Cu	:	not more than 1.0 mass%
Cr	:	not more than 1.0 mass%
Ca	:	not more than 0.01 mass%
REM	:	not more than 0.02 mass%
Mg	:	not more than 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0, and having a microstructure composed of degenerate upper bainite of more than 70%, in which;

the ratio (Hv-ave)/(Hv-M*) between the average Vickers hardness Hv-ave in the direction of thickness of the base metal and the martensitic hardness Hv-M* determined by carbon content is between 0.75 and 0.9 and the circumferential tensile strength TS-C is between 900 MPa and 1100 MPa,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) + 2Mo$$

$$Hv\text{-}M^* = 290 + 1300C$$

wherein the symbols of elements designate the mass% of the individual elements.

11. (Currently Amended) Ultra-high-strength linepipe having excellent low-temperature toughness ~~described in claim 9 containing~~ prepared by seam-welding steel plate consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%
P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%
Al	:	not more than 0.10 mass%

and, one or more of:

Ni	:	0.1 to 1.5 mass%
B	:	less than 3 ppm
V	:	not more than 0.10 mass%
Cu	:	not more than 1.0 mass%
Cr	:	not more than 1.0 mass%

Ca : not more than 0.01 mass%

REM : not more than 0.02 mass%

Mg : not more than 0.006 mass%

N : 0.001 to 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0, and having a microstructure composed of degenerate upper bainite of more than 70%, in which;

the ratio (Hv-ave)/(Hv-M*) between the average Vickers hardness Hv-ave in the direction of thickness of the base metal and the martensitic hardness Hv-M* determined by carbon content is between 0.75 and 0.9 and the circumferential tensile strength TS-C is between 900 MPa and 1100 MPa,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) + Mo - 1$$

$$Hv\text{-}M^* = 290 + 1300C$$

wherein the symbols of elements designate the mass% of the individual elements.

12. (Original) Ultra-high-strength linepipe having excellent low-temperature toughness described in claim 11, in which the relationship Ti - 3.4 N > 0 is satisfied (wherein the symbols of elements designate the mass% of the individual elements).

13. (Previously Presented) Ultra-high-strength linepipe having excellent low-temperature toughness described in claim 8, in which the V-notch Charpy value at -20°C is not lower than 200J.

14. (Previously Presented) Ultra-high-strength linepipe having excellent low-temperature toughness described in claim 8, in which the tensile strength in the longitudinal direction of linepipe is not greater than 0.95 times the tensile strength in the circumferential direction thereof.

15. (Currently Amended) A method for manufacturing steel plate for ultra-high-strength linepipe having excellent low-temperature toughness comprising the steps of:

heating slabs consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%
P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%
Al	:	not more than 0.10 mass%

and, one or more of:

Ni	:	0.1 to 1.5 mass%
B	:	less than 3 ppm
V	:	not more than 0.10 mass%
Cu	:	not more than 1.0 mass%
Cr	:	not more than 1.0 mass%
Ca	:	not more than 0.01 mass%
REM	:	not more than 0.02 mass%
Mg	:	not more than 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0 and between 1000 and 1250°C, <u>and having a microstructure composed of degenerate upper bainite of more than 70%,</u>

rough rolling in a recrystallizing region,

rolling in an unrecrystallization austenitic region at 900°C or below with a cumulative rolling reduction of not less than 75% and, then,

applying accelerated cooling from the austenitic region so that the center of plate thickness cools to 500°C or below at a rate of 1 to 10 °C/sec.,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) + Mo - 1$$

wherein the symbols of elements designate the mass% of the individual elements.

16. (Currently Amended) A method for manufacturing steel plate for ultra-high-strength linepipe having excellent low-temperature toughness comprising the steps of:

heating slabs consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%
P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%
Al	:	not more than 0.10 mass%
B	:	3 ppm to 0.0025 mass%

and, one or more of:

Ni	:	0.1 to 1.5 mass%
N	:	0.001 to 0.006 mass%
V	:	not more than 0.10 mass%
Cu	:	not more than 1.0 mass%
Cr	:	not more than 1.0 mass%

Ca	:	not more than 0.01 mass%
REM	:	not more than 0.02 mass%
Mg	:	not more than 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0 and between 1000 and 1250°C, and having a microstructure composed of degenerate upper bainite of more than 70%,

rough rolling in a recrystallized region,

rolling in an unrecrystallization austenitic region at 900°C or below with a cumulative rolling reduction of not less than 75% and, then,

applying accelerated cooling from the austenitic region so that the center of plate thickness cools to 500 °C or below at a rate of 1 to 10 °C/sec.,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) + 2Mo$$

wherein the symbols of elements designate the mass% of the individual elements.

17. (Currently Amended) A method for manufacturing steel plate for ultra-high-strength linepipe having excellent low-temperature toughness ~~described in claim 15, in which slabs also contain~~ comprising the steps of:

heating slabs consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%
P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%

Al : not more than 0.10 mass%

and, one or more of:

Ni : 0.1 to 1.5 mass%

B : less than 3 ppm

V : not more than 0.10 mass%

Cu : not more than 1.0 mass%

Cr : not more than 1.0 mass%

Ca : not more than 0.01 mass%

REM : not more than 0.02 mass%

Mg : not more than 0.006 mass%

N : 0.001 to 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0 and between 1000 and 1250°C, and having a microstructure composed of degenerate upper bainite of more than 70%,

rough rolling in a recrystallizing region,

rolling in an unrecrystallization austenitic region at 900°C or below with a cumulative rolling reduction of not less than 75% and, then,

applying accelerated cooling from the austenitic region so that the center of plate thickness cools to 500°C or below at a rate of 1 to 10 °C/sec.,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) + Mo - 1$$

wherein the symbols of elements designate the mass% of the individual elements.

18. (Original) A method for manufacturing steel plate for ultra-high-strength linepipe having excellent low-temperature toughness described in 17, in which the relationship Ti - 3.4 N > 0 is satisfied (wherein the symbols of elements designate the mass% of the individual elements).

19. (Previously Presented) A method for manufacturing ultra-high-strength linepipe having excellent low-temperature toughness comprising the steps of:

forming a steel plate manufactured by the methods for manufacturing ultra-high-strength steel plate having excellent low-temperature toughness described in claim 15 into a pipe form so that the rolling direction of the steel plate agrees with the longitudinal direction of a pipe to be manufactured, and

forming a pipe by seam-welding together the edges thereof.

20. (Previously Presented) A method for manufacturing ultra-high-strength linepipe having excellent low-temperature toughness comprising the steps of:

forming a steel plate manufactured by the methods for manufacturing ultra-high-strength steel plate having excellent low-temperature toughness described in claim 15 into a pipe form by the UO process so that the rolling direction of the steel plate agrees with the longitudinal direction of a pipe to be manufactured,

forming a pipe by joining together the edges thereof by applying submerged-arc welding from both inside and outside, and

expanding the welded pipe.

21.(Currently Amended) A method for manufacturing ultra-high-strength linepipe having excellent low-temperature toughness comprising the steps of:

heating slabs consisting essentially of:

C	:	0.03 to 0.07 mass%
Si	:	not more than 0.6 mass%
Mn	:	1.5 to 2.5 mass%
P	:	not more than 0.015 mass%
S	:	not more than 0.003 mass%
Ni	:	0.1 to 1.5 mass%

Mo	:	0.15 to 0.60 mass%
Nb	:	0.01 to 0.10 mass%
Ti	:	0.005 to 0.030 mass%
Al	:	not more than 0.06 mass%

and, one or more of:

B	:	not more than 0.0025 mass%
N	:	0.001 to 0.006 mass%
V	:	not more than 0.10 mass%
Cu	:	not more than 1.0 mass%
Cr	:	not more than 1.0 mass%
Ca	:	not more than 0.01 mass%
REM	:	not more than 0.02 mass%
Mg	:	not more than 0.006 mass%

and the remainder being iron and unavoidable impurities and having the value P defined below being between 2.5 and 4.0 and between 1000 and 1250°C, <u>and having a microstructure composed of degenerate upper bainite of more than 70%,</u>

rough rolling in a recrystallized region,

rolling in an unrecrystallization austenitic region at 900°C or below with a cumulative rolling reduction of not less than 75%,

applying accelerated cooling from the austenitic region so that the center of plate thickness cools to 500°C or below at a rate of 1 to 10°C/sec.,

forming the steel plate thus manufactured into a pipe form so that the rolling direction of the steel plate agrees with the longitudinal direction of a pipe to be manufactured, and

forming a pipe by welding together the edges thereof,

$$P = 2.7C + 0.4Si + Mn + 0.8Cr + 0.45(Ni + Cu) +$$

$$(1 + \beta)Mo - 1+\beta$$

where $\beta = 1$ when $B \geq 3$ ppm and $\beta = 0$ when $B < 3$ ppm

wherein the symbols of elements designate the mass% of the individual elements.

22. (Original) A method for manufacturing ultra-high-strength linepipe having excellent low-temperature toughness described in claim 21, which furthermore comprising the steps of:

forming the steel plate subjected to accelerated cooling into a pipe form by the UO process so that the rolling direction of the steel plate agrees with the longitudinal direction of a pipe to be manufactured,

joining the edges thereof together by applying submerged-arc welding from both inside and outside, and

expanding the welded pipe.

23. (New) Steel plate for ultra-high-strength linepipe having excellent low-temperature toughness described in claim 3, containing:

Si : not more than 0.28 mass%.

24. (New) Steel plate for ultra-high-strength linepipe having excellent low-temperature toughness described in claim 3, containing no Si.

25. (New) Ultra-high-strength linepipe having excellent low-temperature toughness described in claim 11 containing:

Si : not more than 0.28 mass%.

26. (New) Ultra-high-strength linepipe having excellent low-temperature toughness described in claim 11, containing no Si.

27. (New) A method for manufacturing steel plate for ultra-high-strength linepipe having excellent low-temperature toughness described in claim 17, in which slabs also contain:

Si : not more than 0.28 mass%.

28. (New) A method for manufacturing steel plate for ultra-high-strength linepipe having excellent low-temperature toughness described in claim 17, in which slabs also contain no Si.